

REMARKS

Applicant requests entry of the above-identified amendments which conform the claims to U.S. practice. No new matter is being introduced by this Amendment as antecedent support is set forth in the specification and the original claims.

Prosecution on the merits is respectfully requested.

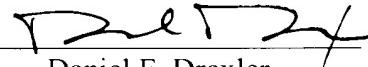
The Examiner is invited to contact the Applicant's attorneys directly at the below-listed telephone number regarding this preliminary amendment or otherwise concerning the present application.

If there are any charges with respect to this Amendment or otherwise, please charge them to Deposit Account No. 06-1130 maintained by Applicant's attorneys.

Respectfully submitted,

HENNING HENNINGSEN

CANTOR COLBURN LLP
Applicant's Attorney

By: 
Daniel F. Drexler
Registration No. 47,535
Customer No. 23413

Date: April 12, 2001

Tel: 860-286-2929

VERSION WITH MARKINGS TO SHOW CHANGES MADE:

IN THE SPECIFICATION

The first paragraph on the first page of the specification is amended as follows:

“[Background of the technique] TECHNICAL FIELD

The invention relates to a so-called rapid prototyping apparatus for the manufacturing of three dimensional objects by additive treatment of cross sections, said cross sections consisting of a wholly or partially light-sensitive material, said rapid prototyping apparatus comprising at least one light source [as stated in the preamble of claim 1].”

The second paragraph on the first page of the specification is amended as follows:

“The invention also relates to a method of manufacturing of three dimensional objects by means of a rapid prototyping apparatus wherein a wholly or partially light-sensitive material is treated by means of illumination of a cross section of the material by at least one spatial light modulator arrangement of controllable light modulators [as stated in the preamble of claim 15].”

The third paragraph on the first page of the specification is amended as follows:

“[Background of the invention] BACKGROUND OF THE INVENTION

In connection with the manufacturing of mechanical prototypes, and especially during the production design processes, recent years have introduced various types of rapid prototyping techniques (RP) where three dimensional objects are manufactured by sequential cross section layers generated by a given illumination, sintering, setting or placing of material etc. on each cross section. The individual cross sections are e.g. generated as computer-aided designs. The advantage of RP is that the manufacturing of expensive molding tools for the design of the apparatus becomes superfluous for its manufacturing, just as difficult and time-consuming modifications of a molding tool may almost be completely avoided.”

The second paragraph on the fourth page of the specification has been amended as follows:

"[The invention] SUMMARY OF THE INVENTION

The invention relates to a rapid prototyping apparatus for the manufacturing of three dimensional objects by additive treatment of cross sections comprising a wholly or partially light-sensitive material, said apparatus comprising at least one light source for illumination of a cross section of the light-sensitive material by at least one spatial light modulator of individually controllable light modulators, wherein at least one light source being optically coupled with a plurality of light guides arranged with respect to the spatial light modulator arrangement in such a manner that each light guide illuminates a sub-area of the cross section."

The second paragraph on the twelfth page of the specification has been amended as follows:

"[Figures] BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be described in detail in the following with reference to the figures where

- Fig. 1 shows an example of an SLA application according to the invention and
- Fig. 2 shows an additional example of the SLA application according to the invention."

The third paragraph on the twelfth page of the specification has been amended as follows:

"[Detailed description] DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Figure 1 shows a schematic diagram of an embodiment according to the invention."

IN THE CLAIMS

The claims are amended as follows:

1. (Amended/Marked Up) Rapid prototyping apparatus for the manufacturing of three dimensional objects by additive treatment of cross sections comprising a wholly or partially light-sensitive material [(2)], said apparatus comprising at least one light source for illumination of a cross section of the light-sensitive material [(2)] by at least one spatial light modulator of individually controllable light modulators,
wherein[

c h a r a c t e r i z e d b y

]the at least one light source [being] is optically coupled to a plurality of light guides [(8)] arranged with respect to the spatial light modulator arrangement in such a manner that each light guide [(8)] illuminates a sub-area of the cross section.

2. (Amended/Marked Up) Rapid prototyping apparatus of claim 1 [c h a r a c t e r i z e d b y] wherein each spatial modulator arrangement compris[ing]es transmissive light valves.
3. (Amended/Marked Up) Rapid prototyping apparatus of claim [1 or] 2 [c h a r a c t e r i z e d b y said apparatus] further comprising a first lens arrangement, said first lens arrangement comprising at least one micro lens arranged with respect to each light valve in such a manner that [that] the emitted light by the light [emitter(s) (8)] guides focuses on or in proximity of [the] an optical axis of the individual light valves.
4. (Amended/Marked Up) Rapid prototyping apparatus of claim[s 1 to 3 c h a r a c t e r i z e d b y said apparatus] 2 further comprising a second lens arrangement, said

second lens arrangement comprising at least one micro lens arranged between the light valves and [the] an illumination surface in such a manner that light transmitted through [the light] channels of the individual light valves is suitably focused on the illumination surface.

5. (Amended/Marked Up) Rapid prototyping apparatus of claim[s] 1 [to 4 c h a r a c t e r i z e d b y] wherein optical fibers[, preferably multi mode fibers,] constitut[ing]e the optical light guides [(8)].
6. (Amended/Marked Up) Illumination device of claim[s] 1 [to 5 c h a r a c t e r i z e d b y] wherein at least one of the light sources [being] is made of a short arc gap lamp.
7. (Amended/Marked Up) Rapid prototyping apparatus of claim[s] 1 to 6 c h a r a c t e r i z e d b y] 2 wherein the individual light valves [being] are arranged in rows in [the] a transverse direction of [the] a surface at a given mutual distance, said rows being mutually displaced in the transverse direction.
8. (Amended/Marked Up) Rapid prototyping apparatus of claim[s] 1 to] 7 [c h a r a c t e r i z e d b y] wherein the rows [being] are arranged in such a manner that the projection of each individual light valve in the transverse direction on the surface results in a number of illumination points at a given mutual distance in the transverse direction.
9. (Amended/Marked Up) Rapid prototyping apparatus of claim[s] 1 [to 8 c h a r a c t e r i z e d b y the] wherein surface profile[(s)]s of the spatial modulator arrangements [being] are arranged on one or more exposure heads, said exposure heads and [said] an illumination surface being designed to make a relative movement, said rapid prototyping apparatus being provided with a control circuitry

for control of the spatial light modulator arrangements in dependency of the movement between the exposure head and the illumination surface.

10. (Amended/Marked Up) Rapid prototype apparatus of claim[s] 1 [to 9 c h a r a c t e r i z e d b y the] further comprising an exposure head[(s)] comprising a bar whose relative movement over [the] an illumination surface consists of one single progressing movement in [the] a transverse direction of the bar.
11. (Amended/Marked Up) Rapid prototyping apparatus of claim[s] 1 [to 10 c h a r a c t e r i z e d b y the] further comprising an illumination device between the spatial light modulator arrangement and [the] an illumination surface comprising optical means for the spreading of the light beams emitted by the light modulator arrangement over the illumination surface.
12. (Amended/Marked Up) Rapid prototyping apparatus according to claim[s] 1 [to 11 c h a r a c t e r i z e d b y] wherein the modulator arrangement of the illumination device [being] includes spatial light modulators such as LCD, PDLC, PLZT, FELCD or Kerr cells.
13. (Amended/Marked Up) Rapid prototyping apparatus of claim[s] 1 [to 12 c h a r a c t e r i z e d b y] wherein the modulator arrangement of the illumination device [being] is reflective electromechanical light valves [such as DMD].
14. (Amended/Marked Up) Rapid prototyping apparatus of claim[s] 1 to 13 c h a r a c t e r i z e d b y] 2 wherein the light guides of the illumination device [being] are arranged with respect to the modulator arrangement in such a manner that [the furnished] optical energy furnished to each subset of light valves does not vary significantly once the subsets of light valves illuminate adjacent sub-areas in close proximity to each other on [the] an illumination surface.

15. (Amended/Marked Up) Method of manufacturing three dimensional objects by means of a rapid prototyping apparatus where a wholly or partially light-sensitive material is treated by at least one light source illuminating a cross section of the material by at least two modulator arrangements of individually controllable light modulators, wherein[

c h a r a c t e r i z e d b y

]at least one light source [being] is optically coupled with a plurality of light guides [(8)] arranged with respect to the spatial light modulator arrangement in such a manner that each light guide [(8)] illuminates a sub-area of the cross section.

16. (Amended/Marked Up) Method of claim 15 [c h a r a c t e r i z e d b y] wherein a wholly or partially light-sensitive material [(2) being] is placed in a layer on a plate [(24)] in a container and subsequently exposed to an RP apparatus prior to creating a new layer on top of the previous layer.
17. (Amended/Marked Up) Method of claim 15 [or 16 c h a r a c t e r i z e d b y] wherein an RP apparatus [being] is provided with a computer-aided design program wherein a 3D representation of the desired prototype it converted into files containing a cross section of the prototype and wherein the contents of the files are used to control the spatial light modulator arrangement.

IN THE ABSTRACT

The abstract is amended as follows:

"[Abstract:] ABSTRACT

The invention relates to a rapid prototyping apparatus for the manufacturing of three dimensional objects by additive treatment of cross sections comprising a wholly or partially light-sensitive material [(2)], said apparatus comprising at least one light source for illumination of a cross section of the light-sensitive material [(2)] by at least one spatial light modulator of individually controllable light modulators, wherein at least one light source is optically coupled with a plurality of light guides [(8)] arranged with respect to the spatial light modulator arrangement in such a manner that each light guide [(8)] illuminates a sub-area of the cross section.

According to the invention, it is possible to obtain a significant simplification of an RP design system, just as the apparatuses designed are essentially capable of creating prototypes of any size, according to the invention."